

Having described the preferred embodiments, the invention is now claimed to be:

1. A computed tomography imaging system including:
 - a rotating gantry (20) defining an examination region (16);
 - a first radiation source (22) disposed on the rotating gantry (20) and arranged to emit first radiation (32) into the examination region (16);
 - a second radiation source (24) disposed on the rotating gantry (20) and arranged to emit second radiation (36) into the examination region (16), the second radiation source (24) being angularly spaced around the gantry from the first radiation source (22);
 - a first radiation detector (30, 30') arranged to receive the first radiation (32), a center of the first radiation detector (30, 30') being angularly spaced around the gantry from the first radiation source (22) by less than 180°;
 - a second radiation detector (34) arranged to receive the second radiation (36), a center of the second radiation detector (34) being angularly spaced around the gantry from the second radiation source (24) by less than 180°; and
 - a reconstruction processor (86) that reconstructs projection data acquired during gantry rotation by the first and second radiation detectors (30, 30', 34) into one or more image representations.
2. The computed tomography imaging system as set forth in claim 1, wherein the first radiation detector (30, 30') includes:
 - a high resolution portion (54, 54') having detector elements of a first size; and
 - a low resolution portion (56, 56') having detector elements of a second size, the second size being larger than the first size.
3. The computed tomography imaging system as set forth in claim 2, wherein the second radiation detector (34) includes:
 - a high resolution portion (60) having detector elements of the first size; and
 - a low resolution portion (62) having detector elements of the second size;wherein the high resolution portions (54, 54', 60) of the first and second radiation detectors (30, 30', 34) are arranged angularly between the low resolution portions (56, 56', 62) of the first and second radiation detectors (30, 30', 34) on the rotating gantry (20).
4. The computed tomography imaging system as set forth in claim 3, further including:

a non-stationary filter (80, 82) that smooths a transition between projection data acquired by the low resolution portions (56, 56', 62) of the first and second radiation detector arrays (30, 30', 34) and projection data acquired by the high resolution portions (54, 54', 60) of the first and second radiation detector arrays (30, 30', 34).

5. The computed tomography imaging system as set forth in claim 2, wherein:

the angular spacing of the first radiation detector (30, 30') from the first radiation source (22) by less than 180° defines symmetric and asymmetric beam components of the first radiation (32), the symmetric beam component being centered on a rotational center (38) of the rotating gantry (20);

the high resolution portion (54, 54') of the first radiation detector (30, 30') is arranged to receive the symmetric beam component; and

the low resolution portion (56, 56') of the first radiation detector (30, 30') is arranged to receive the asymmetric beam component.

6. The computed tomography imaging system as set forth in claim 1, wherein the first and second radiation detectors (30, 30', 34) each span greater than 90° around the gantry (20).

7. The computed tomography imaging system as set forth in claim 1, wherein the second radiation source (24) is angularly spaced from the first radiation source (22) by 90°.

8. The computed tomography imaging system as set forth in claim 1, wherein the second radiation source (24) is angularly spaced from the first radiation source (22) by at least 90°, and each of the first and second radiation detectors (30, 30', 34) spans greater than 90° around the gantry (20).

9. The computed tomography imaging system as set forth in claim 1, wherein the first and second radiation sources (22, 24) lie in a plane parallel to a plane of gantry rotation.

10. The computed tomography imaging system as set forth in claim 1, wherein the first and second radiation sources (22, 24) are relatively offset in an axial direction (z) by one-half of an axial spacing of detector elements of the first and second radiation detectors (30, 30', 34).

11. The computed tomography imaging system as set forth in claim 1, wherein the first and second radiation sources (22, 24) are relatively offset in an axial direction (z) by less than an axial dimension of the conebeam at a scan-center.

12. The computed tomography imaging system as set forth in claim 1, wherein the first and second radiation sources (22, 24) are conebeam radiation sources, and the first and second radiation detectors (30, 30', 34) are two-dimensional arrays, the computed tomography imaging system further including:

a support element (72) for supporting an associated imaging subject in the examination region (16), the support element (72) being linearly movable in an axial direction (z), simultaneous gantry rotation and axial motion of the support element (72) effecting a helical orbit of the first and second radiation sources (22, 24) relative to the associated imaging subject during acquisition of the projection data.

13. The computed tomography imaging system as set forth in claim 12, wherein the first and second radiation sources (22, 24) are relatively offset in the axial direction (z) by an amount such that the second radiation source (24) follows the first radiation source (22) along the helical orbit.

14. The computed tomography imaging system as set forth in claim 1, wherein:
the first radiation detector (30, 30') includes a first anti-scatter grid (66, 66') focused on the first radiation source (22); and
the second radiation detector (34) includes a second anti-scatter grid (68) focused on the second radiation source (24).

15. The computed tomography imaging system as set forth in claim 1, wherein:
a first radiation energy of the first radiation (32) is different from a second radiation energy of the second radiation (36); and
the reconstruction processor (86) reconstructs projection data acquired by the first and second radiation detector arrays (30, 30', 34) into one or more combined image representations having contributions from projection data acquired by the first and second radiation detector arrays (30, 30', 34).

16. The computed tomography imaging system as set forth in claim 1, further including:
a radiation source control (70) that alternates between generating radiation by the first radiation source (22) and generating radiation by the second radiation source (24) such that the first and second radiation sources (22, 24) are not simultaneously generating radiation.

17. The computed tomography imaging system as set forth in claim 1, wherein the reconstruction processor (86) includes:

a backprojector (94); and

a weighting processor (92) that applies a weighting function to projection data prior to backprojecting, the weighting processor (92) applying a first weighting function to projection data for reconstruction of voxels in a central region (48) of the examination region (16), the weighting processor applying a second weighting function for reconstruction of voxels outside the central region (48), the second weighting function being dependent upon a distance of the voxel from the center of rotation (38).

18. The computed tomography imaging system as set forth in claim 1, further including:

a first asymmetrically adjustable collimator (26) for adjusting an edge of the first radiation (32); and

a second asymmetrically adjustable collimator (28) for adjusting an edge of the second radiation (36).

19. A computed tomography imaging system including:

a rotating gantry (20, 120) defining an examination region (16, 116), the examination region (16, 116) including a central region (48, 148) that contains a center of rotation (38, 138) of the rotating gantry (20, 120) and a surrounding region (50, 150) that surrounds the central region (48, 148), the rotating gantry (20, 120) further defining a gantry plane of gantry rotation and an axial direction (z);

a first radiation source (22, 122) disposed on the rotating gantry (20, 120), the first radiation source (22, 122) producing first radiation (32, 132) directed into the examination region (16, 116);

a first radiation detector array (30, 30', 130) arranged to receive the first radiation (32, 132) after the first radiation (32, 132) passes through the examination region (16, 116), the first detector array (30, 30', 130) including:

a high resolution portion (54, 54', 152) with detector elements of a first size that receive first radiation (32, 132) that passes through the central region (48, 148), and

a low resolution portion (56, 56', 154, 156) with detector elements of a second size that receive first radiation (32, 132) that passes through the surrounding region (50, 150) but not the central region (48, 148),

wherein the second size is larger than the first size; and

a reconstruction processor (86) that reconstructs projection data acquired during gantry rotation by at least the first radiation detector array (30, 30', 130) into an image representation.

20. The computed tomography imaging system as set forth in claim 19, further including:

a second radiation source (24) disposed on the rotating gantry (20), the second radiation source (24) being positioned at an angular offset on the rotating gantry (20) relative to the first radiation source (22), the second radiation source (24) producing second radiation (36) directed into the examination region (16);

a second radiation detector array (34) arranged to receive the second radiation (36) after the second radiation (36) passes through the examination region (16), the second detector array (34) including:

a high resolution portion (60) with detector elements of a third size that receive second radiation (36) that passes through the central region (48), and

a low resolution portion (62) with detector elements of a fourth size that receive second radiation that passes through the surrounding region (50) but not the central region (48),

wherein the fourth size is larger than the third size, and the reconstruction processor (86) reconstructs projection data acquired during gantry rotation by both the first and second radiation detector arrays (30, 34) into one or more image representations.

21. The computed tomography imaging system as set forth in claim 20, wherein the first and second radiation detector arrays (30, 34) together define a single unitary radiation detector array, the single unitary radiation detector array including:

a central high resolution portion defined by the high resolution portions (54, 60) of the first and second radiation detector arrays (30, 34);

a first outer low resolution portion defined by the low resolution portion (56) of the first radiation detector array (30); and

a second outer low resolution portion defined by the low resolution portion (62) of the second radiation detector array (34), wherein the central high resolution portion is arranged between the first and second outer low resolution portions.

22. The computed tomography imaging system as set forth in claim 20, wherein the high resolution portions (54, 54', 60) of the first and second radiation detector arrays (30, 30', 34) are arranged on the rotating gantry (20) between the low resolution portions (56, 56', 62) of the first and second radiation detector arrays (30, 30', 34).

23. The computed tomography imaging system as set forth in claim 20, wherein the reconstruction processor (86) includes:

a backprojector (94); and

a weighting processor (92) that weights the projection data prior to backprojecting, the weighting processor (92) applying:

90° weighting windows for backprojecting voxels in the central region (48) of the examination region (16),

180° weighting windows for backprojecting voxels in the surrounding region (50) of the examination region (16), and

asymmetric weighting windows for backprojecting voxels in a transition region intermediate between the central region (48) and the surrounding region (50).

24. The computed tomography imaging system as set forth in claim 19, wherein the low resolution portion (154, 156) includes two low resolution sub-portions (154, 156) of equal size, the high resolution portion (152) being disposed between the two low resolution sub-portions (154, 156) such that the first radiation detector array (130) is a symmetric detector array.

25. The computed tomography imaging system as set forth in claim 19, wherein each detector element of the low resolution portion (56, 56', 154, 156) includes a plurality of detector elements of the first size that are electrically interconnected.

26. A computed tomography imaging method including:

passing first radiation (32, 132) through an examination region (16, 116), the examination region (16, 116) including a central region (48, 148) and a surrounding region (50, 150);

measuring central projections corresponding to rays of first radiation (32, 132) that intersect the central region (48, 148), the measuring using a first high-resolution detector array (54, 54', 152) that has a first spacing of detector elements;

measuring surrounding projections corresponding to rays of first radiation (32, 132) that intersect the surrounding region (50, 150) without intersecting the central region (48, 148), the measuring using a first low-resolution detector array (56, 56', 154, 156) that has a second spacing of detector elements, the second spacing being larger than the first spacing; and

reconstructing the central projections and the surrounding projections to generate a reconstructed image representation.

27. The method as set forth in claim 26, further including:

passing second radiation (36) through the examination region (16);

measuring central projections corresponding to rays of second radiation (36) that intersect the central region (48), the measuring using a second high-resolution detector array (60) that has the first spacing of detector elements;

measuring surrounding projections corresponding to rays of second radiation (36) that intersect the surrounding region (50) without intersecting the central region (48), the measuring using a second low-resolution detector array (62) that has the second spacing of detector elements.

28. The method as set forth in claim 27, wherein the first radiation (32) is substantially monochromatic at a first energy and the second radiation (36) is substantially monochromatic at a second energy that is different from the first energy, and the reconstructing includes:

reconstructing the central projections measured using the first high-resolution detector array (54, 54') and the surrounding projections measured using the first low-resolution detector array (56, 56') to generate a first reconstructed image representation; and

reconstructing the central projections measured using the second high-resolution detector array (60) and the surrounding projections measured using the second low-resolution detector array (62) to generate a second reconstructed image representation.

29. The method as set forth in claim 27, wherein the passing of the first radiation (32) and the passing of the second radiation (36) do not overlap temporally.

30. The method as set forth in claim 27, wherein the reconstructing includes:

combining 90° contiguous angular segments of central projections during reconstructing of voxels within the central region (48, 148); and

combining 180° contiguous angular segments of central and surrounding projections during reconstructing of voxels in the surrounding region (50, 150) outside a transition radius.

31. A computed tomography imaging method including:

passing first and second angularly rotating and angularly offset asymmetric radiation beams (32, 36) through an examination region (16), the first and second angularly rotating and angularly offset asymmetric radiation beams (32, 36) defining a central region (48) that is continuously sampled by both first and second asymmetric radiation beams (32, 36) during the angular rotating and a surrounding region (50) that is not sampled over a portion of the angular rotating;

detecting the first and second asymmetric radiation beams (32, 36) after said beams pass through the examination region (16) to generate first and second radiation projection data; and

reconstructing voxels based on the first and second radiation projection data, the reconstructing including smoothing projection data of voxels in a transition region (T) between the central region (48) and the surrounding region (50).